Are Flowering Plants Taboo in Peach Orchards?

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Abstract

It is generally recommended that broadleaf plants in and around peach orchards must be controlled to minimize damage from stink bugs (Pentatomidae) and plant bugs (*Lygus* spp.). In research orchards located in West Virginia, USA, I have been growing peach trees as a monoculture or interplanted with apple, with and without the presence of broadleaf flowering plants. The flowering plants were used to enhance biological control of peach and apple insect pests. For two years, 1999 and 2000, damage to fruit by stink bug and plant bug was not significantly different in orchards with flowering plants and reduced insecticides as compared with an insecticide treated check orchard with just grass row middles and scattered broadleaf weeds. I suggest that vigorous, flowering broadleaf plants in peach orchards are more attractive hosts for stink bugs and plant bugs than are the peach fruit, and their presence can reduce damage by these insects thereby reducing the need for insecticide applications through early and mid-summer.

INTRODUCTION

A major barrier to implementing more intensive integrated pest management of peach (*Prunus persica* (L.) Batsch) in the eastern United States is the difficulty of monitoring and controlling stink bugs and plant bugs (Brown et al., 1999). These insects cause catfacing damage, a disfigurement of the fruit making it unmarketable, if they feed on the fruit prior to pit hardening (Polk et al., 1995). Later feeding, primarily by stink bugs, can cause a depressed corky or water-soaked region on the fruit where feeding occurred and gum droplets may form (Polk et al., 1995). Control of stink bugs and plant bugs is generally done by using a calendar based cover spray schedule to maintain a protectant residue on the fruit (Pennsylvania State University, 2000). It is also recommended that broadleaf weeds in and around peach orchards be removed to reduce stink bug and plant bug damage (Polk et al., 1995; University of California, 1999; Pennsylvania State University, 2000). Killian and Meyer (1984) showed a significant reduction in catfacing damage to peach in herbicide treated compared with non-herbicide treated orchards. In a research orchard in eastern West Virginia, USA, I have been growing broadleaf flowering plants in peach orchards to increase biodiversity with a goal of enhancing biological control. Here, I report on the effect of these flowering plants on stink bug and plant bug damage to the peach fruit.

MATERIALS AND METHODS

Experimental Design

Four 0.5 ha orchards were planted in April, 1997, at a density of 560 trees/ha, with peach ('Loring'/'Lovell'), apple ('Granny Smith'/EMLA 26 and 'Royal Empire'/M9/EMLA 111), pear ('Buerre Bosc'/'Bartlett' and 'Seckel'/'Bartlett'), and sweet cherry ('Emperor Francis'/'Mazzard' and 'Ulster'/'Mazzard') in Jefferson Co., WV. For the first two years, ground cover management was identical in all four blocks with an herbicide strip maintained in the tree rows, primarily with glyphosate and paraquat. Alternating strips of the following flowering annual companion plants were planted adjacent to the tree rows in two orchards in May 1999 and 2000: buckwheat (*Fagopyrum esculentum*), dill

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(*Anethum graveolens*), purple tansy (*Phacelia tanacetifolia*), and a mixture of native wild flowers. The strips of companion plants were 0.75 m wide from the edge of the grass alley toward the tree, leaving a 1.5 m wide bare strip under the trees. All orchards had the same fungicide treatment schedule, and were treated with mating disruption for oriental fruit moth, *Grapholitha molesta* in 1999 and 2000; lesser peach tree borer, *Synanthedon pictipes*; and greater peach tree borer, *Synanthedon exitiosa*, in 2000. The conventional orchard was planted half in a monoculture of peach and half in a monoculture of the two apple cultivars. A conventional spray schedule was used for insect management (Table 1). The reduced spray/flowering plant orchard was planted with the same design as the conventional orchard with monocultures of peach and apple but also had strips of flowering plants. A reduced spray schedule was used for insect management (Table 1). The reduced spray/polycrop orchard was planted as a polyculture with alternating pairs of peach and apple trees within and between tree rows. To further increase plant diversity, ten pairs of peach were replaced with sweet cherry, and ten pairs of apple were replaced with pear. This orchard received the reduced spray schedule. The reduced spray/flowering plant/polycrop orchard was planted as a polyculture as described for the reduced spray/polycrop orchard, had flowering plant strips added, and was sprayed with the reduced spray schedule.

Data Collection

For each treatment, 15 randomly selected peach trees were completely harvested to estimate yield. To evaluate insect injury, 20 randomly selected fruit from each of 25 peach trees were harvested and evaluated in the laboratory. Damage recorded as "catface" was caused by either stink bug or plant bug that occurred early enough for the peach flesh to grow around the damage to cause the characteristic fruit deformation. Damage recorded as "stink bug" could also have been made by plant bug and was a result of feeding late in the season, appearing as a depressed water-soaked area around the feeding site. Percent fruit damaged was transformed with the square root/arcsine and yield data with log (y) to adjust for normality where needed. Data were analyzed with general linear model analysis of variance with mean separation by least squares (SAS Institute 1996).

RESULTS

There was no statistical difference among treatments in amount of catface or stink bug damage in either year (Table 2). There was generally lower amounts of damage from both catface and stink bug in 2000 than in 1999 (Table 2). Catface damage ranged from 4.1 to 6.9 percent damage in 1999 and 0.3 to 1.9 percent in 2000. Stink bug damage ranged from 2.0 to 3.6 percent damage in 1999 and 0.1 to 0.2 percent in 2000. Yield was greater in the orchards with flowering plants than either orchard without flowering plants in 1999 (Table 2). Yield was not statistically different between orchards without flowers and the polycrop orchard with flowers, but the monocrop orchard with flowers did have significantly lower fruit yield than the conventional orchard (Table 2). Cumulative yield over the two years was very similar, ranging from 28.2 kg/tree in the polycrop orchard to 31.8 kg/tree in the polycrop orchard with flowers.

DISCUSSION

The presence of flowering broadleaf plants did not increase the amount of damage by stink bug or plant bug as compared with orchards without the increased abundance of broadleaf plants. The polycrop orchard without flowers also did not have any greater damage from these pests as compared with the conventionally managed orchard. The reduced-spray orchards had only *Bt* and spinosad applied after late May, neither of which would have any activity against stink bugs or plant bugs. The flowering plants in this study were kept vigorous throughout the time peach fruit were present and were apparently more attractive to stink bugs and plant bugs than were the fruit. The flowers not only are providing resources for beneficial insects but are also acting as a trap crop for stink bugs and plant bugs. If these results can be replicated in other areas, the use of flowering trap crops, in conjunction with mating disruption for oriental fruit moth, in peach orchards could lead to a more intensive integrated pest management plan with fewer insecticides being required in the eastern US.

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Tables

Table 1. Insecticide application schedule for the conventionally managed orchard and reduced insecticide orchard. "Border spray" indicates only the trees on the exterior of the orchard were sprayed, "trunk spray" indicates insecticide applied only to trunks and lower branches of peach and cherry.

Date	Conventional	Reduced schedule
1999		
8 April	chlorpyrifos	chlorpyrifos
11 May	azinphosmethyl	azinphosmethyl, border spray
20 May	esfenvalerate	phosmet, border spray
3 June	methomyl	*Bacillus thuringiensis* (*Bt*)
23 June	endosulfan, phosmet	*Bt*
25 August	azinphosmethyl	*Bt*
1 September		*Bt*
15 September	chlorpyrifos, trunk spray	chlorpyrifos, trunk spray
2000		
24 April	esfenvalerate	
5 May	esfenvalerate	phosmet
19 May	chlorpyrifos	*Bt*
2 June	methomyl	spinosad
16 June	methomyl	
30 June	methomyl	
27 July	phosmet	
11 August	phosmet	spinosad

Table 2. Peach fruit damage by catfacing (feeding by plant bug or stink bug in early summer) and stink bug (late summer feeding) and yield in the 4 orchard treatments, for the years 1999 and 2000. Means followed by the same letter within a row are not significantly different, least squares, P=0.05.

		Reduced-spray		
	Conventional	flowers	polycrop	polycrop, flowers
1999				
% catface damage	4.5 a	6.9 a	4.3 a	4.1 a
% stink bug damage	3.6 a	2.2 a	2.0 a	3.0 a
yield (kg fruit/tree)	13.9 b	21.5 a	16.2 b	18.2 ab
2000				
% catface damage	0.3 a	1.9 a	1.1 a	0.7 a
% stink bug damage	0.1 a	0.1 a	0.1 a	0.2 a
yield (kg fruit/tree)	17.2 a	8.9 b	12.2 ab	13.6 ab